

REMARKS

Claims 1-16 are pending. Claims 3, 6, 9, and 13-16 have been withdrawn from consideration pursuant to the previous restriction requirement. Applicants have carefully considered the May 22, 2006 Office Action, and the amendments above together with the comments that follow are presented in a bona fide effort to address all issues raised in that Action and thereby place this case in condition for allowance.

In response to the Office Action dated May 22, 2006, claims 1, 4, 7 and 10-12 have been amended. Care has been exercised to avoid the introduction of new matter. Adequate descriptive support for the present Amendment should be apparent throughout the originally filed disclosure as, for example, the depicted embodiments and related discussion thereof in the written description of the specification, including page 4, lines 6 to 10 and on page 7, lines 2 to 25 of the present specification. Applicants submit that the present Amendment does not generate any new matter issue. Entry of the present Amendment is respectfully solicited. It is believed that this response places this case in condition for allowance. Hence, prompt favorable reconsideration of this case is solicited.

Claim 1-2 and 10 were rejected under the first and/or second paragraphs of 35 U.S.C. § 112. The Examiner asserted that the claim phrase “austenite grain size number exceeding 10” does not appear to be an internationally recognized standard and that the previously submitted technical publication does not define a grain size number exceeding 10 as claimed. Applicants respectfully request reconsideration and withdrawal of the rejections in view of the previously submitted technical publication (Japanese Industrial Standards (JIS - 1998), entitled “Methods of austenite grain size determination for steel”) and the following remarks.

As to the phrase “austenite grain size number exceeding 10” in claims 1 and 10, Applicants submit the phrase is an internationally recognized and that one having ordinary skill in this art would have understood meaning of the known standard. Moreover, Applicants request reconsideration of the Examiner’s assertion that the JIS-1998 publication does not disclose a grain size number exceeding 10, as presently claimed.

The JIS-1998 technical publication describes that the relationship $m = 8 \times 2^G$ is established between a grain size number G and the number m of crystal grains per 1 mm^2 . From this expression a relationship can be derived between a grain size number and an average size of crystal grains. For example, a grain size number of 10, it can be found that a relationship of $2^{10} = 8,192$ crystal grains per 1 mm^2 exists and that the crystal grains have an average size of 0.000122 mm^2 . Furthermore, for a grain size number in excess 10, namely 11, it can be found that a $2^{11} = 16,384$ crystal grains exist per 1 mm^2 and that the crystal grains have an average size of 0.000061 mm^2 . Thus, contrary to the Examiner’s assertion, the JIS-1998 technical publication does disclose a crystal grain size for a grain size number exceeding 10, as claimed. Accordingly, Applicants submit that one having ordinary skill in this art would have understood the meaning of the phrase “austenitic grain size number” since the phrase is an internationally recognized standard as evident from the JIS-1998 technical publication. Reconsideration and withdrawal of the rejection under the first and/or second paragraphs of 35 U.S.C. § 112 are solicited.

Claims 1-2, 4-5 and 10-11 were rejected under 35 U.S.C. § 102(e) as being anticipated over Maeda et al. (U.S. Pat. No. 6,423,158, hereinafter “Maeda”). In the statement of the rejection, the Examiner refers to Maeda, applying the disclosure of a structure corresponding to that defined in independent claims 1, 4, 10 and 11, as well as dependent claims 2 and 5. The Examiner asserted that the claimed fracture stress value is an inherent characteristic of Maeda’s steel structure. The

Examiner relies on the doctrine of inherency for the austenitic grain size number limitation recited in independent claims 1 and 10. Applicants respectfully traverse.

Claims 1, 4, 10 and 11 have been amended to describe that steel is carbo-nitrided at a temperature exceeding an A1 transformation point and then cooled to a temperature of less than the A1 transformation point, and subsequently reheated to a range of temperature higher than the A1 transformation point and is quenched. The temperature of reheating is a range of 790°C to 830°C (claims 10 and 11). This is described on page 4, lines 6 to 10 and on page 7, lines 2 to 25 of the present specification.

Maeda describes a method of thermal treatment in which steel that contains C: 0.8-1.5%, Si: 0.4-1.2%, Mn: 0.8-1.5% and Cr: 0.8-1.8% is used as a source material, which is carbonitrided and then quenched and tempered. The quench starts at 830-880°C.

When the present invention and Maeda are compared, it is found that quenching starts at different temperatures. More specifically, the former starts to quench steel at 790-830°C, whereas the latter does so at 830-880°C. If they quench the same material, the one that starts quenching the material at a higher temperature provides retained austenite having a larger grain size. Thus, Maeda provides retained austenite having a grain size corresponding to 830-880°C and hence smaller than a grain size number of 10.

In contrast, the present invention cools carbonitrided steel to a temperature lower than an A1 transformation point to reset (or remove) austenite grains generated in carbonitriding, and starts to quench the steel at a low temperature range of 790°C to 830°C, which provides austenite grains having a size corresponding to 790°C to 830°C and hence falling within a range exceeding a grain size number of 10, as required in independent claims 1 and 10. Accordingly, Maeda fails to identically disclose or suggest every limitation of independent claims 1 and 10. *In re*

Rijckaert, 9 F.3d 1531, 28 USPQ2d 1955 (Fed. Cir. 1993); *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 221 USPQ 481 (Fed. Cir. 1984).

In view of the foregoing differences between Maeda and the present claimed subject matter, Applicants submit that the Examiner's reliance on the doctrine of inherency with respect to the claimed fracture stress value (claims 4 and 11) is misplaced. There is no factual basis to support the Examiner's assertion and it is well established that inherency requires certainty not speculation. *Crown Operations International Ltd. v. Solutia Inc.*, 289 F.3d 1367, 62 USPQ2d 1917 (Fed. Cir. 2002). Applicants submit that Maeda does not disclose or suggest a fracture stress value of no less than 2,650 MPa and, therefore, fails to identically disclose or suggest every limitation of independent claims 4 and 11.

In view of the foregoing, the rejection of claims 1-2, 4-5 and 10-11 under 35 U.S.C. § 102(e) is not legally viable and should be withdrawn.

Independent claims 7 and 12 were rejected under 35 U.S.C. § 102(e) as being anticipated over Takemura et al. (U.S. Pat. No. 6,440,232, hereinafter "Takemura"). The Examiner refers to Takemura at Table 2 (cols. 9-10), applying the disclosure of a structure corresponding to that defined in independent claims 7 and 12. Applicants respectfully traverse.

Independent claims 7 and 12 have been amended to describe that steel is carbo-nitrided at a temperature exceeding an A1 transformation point and then cooled to a temperature of less than the A1 transformation point, and subsequently reheated to a range of temperature higher than the A1 transformation point and is quenched. The temperature of reheating is a range of 790°C to 830°C (claim 12). This is described on page 4, lines 6 to 10 and on page 7, lines 2 to 25 of the present specification.

Takemura's thermal treatment method subjects specimens to carbonitriding heating hardening in an atmosphere of endothermic gas, enriched gas and ammonia gas at a temperature of from 920 to 960°C. Thereafter, the specimens are allowed to cool and cleansed. The specimens are then heated (through hardening) for 0.5 to 3 hours up to 830 to 870°C in an atmosphere of endothermic gas and then oil quenched (hardened). Subsequently, the specimens were cleansed and thereafter heated for 1 to 5 hours in the atmosphere of the air at a temperature in a range of from 160 to 200°C and then cooled (tempered).

When the present invention and Takemura are compared, it is found that they start quenching at different temperatures. More specifically, the former starts to quench steel at 790-830°C, whereas the latter, does so at 830-870°C. Thus, Takemura does not provide an austenite grain exceeding a grain size number of 10. Moreover, as a result, Takemura does not provide a non-diffusible hydrogen content of no more than 0.5 ppm.

In view of the foregoing, the rejection of claims 7 and 12 under 35 U.S.C. § 102(e) is not legally viable and should be withdrawn.

Dependent claim 8 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Takemura in view of Maeda. Applicants respectfully traverse. Applicants incorporate herein the arguments previously advanced in traversal of the rejection under 35 U.S.C. § 102(b) predicated upon Takemura. Dependent claim 8 is free from the applied art in view of its dependency from claim 7. If any independent claim is non-obvious under 35 U.S.C. § 103(a), then any claim depending therefrom is non-obvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). The rejection of claim 8 under 35 U.S.C. § 103(a) is not legally viable and should be withdrawn.

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It is believed that the pending claims are now in condition for allowance. Applicants therefore respectfully request an early and favorable reconsideration and allowance of this application. If there are any outstanding issues which might be resolved by an interview or an Examiner's amendment, the Examiner is invited to call Applicants' representative at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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